Using a Bore Sight Camera as an AR&D Sensor, Phase I

Completed Technology Project (2008 - 2008)

Project Introduction

Orion requires a rendezvous and docking sensor to provide relative navigation information during proximity operations and docking. In order to dock, the sensor must provide full six degree of freedom (6 DOF) relative position and relative attitude information at a rate sufficient for the rendezvous spacecraft guidance system to robustly control the docking maneuver. Orion faces critical weight issues that make inclusion of multiple sensors for AR&D unlikely in its baseline configuration. Locations for mounting the sensors external to the spacecraft are also critical issues. A bore sight camera however will be included in the design to furnish crew video data for the final docking maneuvers. Clever utilization of this existing Orion bore sight camera can provide a robust 6DoF capability with only the addition of vision processing software.

Anticipated Benefits

Formation flying is important for the Department of Defense (DoD) as well as NASA. Relative position and attitude measurements would enable next-generation surveillance missions involving formation flying with tight tolerances. These AR&D sensor technologies can enable advances in in-flight aerial refueling for DoD aircraft, particularly unmanned aerial vehicles (UAVs). Enhancing UAV capabilities is one of the major focus areas of DoD research and development funding. Finally, the commercial space market, fueled by prizes similar to the 2004 Ansari X-prize, has made orbital vehicles with AR&D capabilities the next great priority for privately-funded spacecraft. There are numerous potential applications for AR&D within the NASA. The Orion crew will require a relative navigation sensor to successfully dock with the ISS. The COTS program seeks to provide commercial resupply to the ISS. A prox ops sensor and automated control system is required to hold the rendezvous vehicle in a control box such that the SSRMS can grapple the payload and berth it to the ISS. The Exploration initiative requires an automated docking in lunar orbit in order to safely return the crew to earth. Space construction in lunar orbit will be required to support the colonization of the lunar surface and an expedition to Mars. AR&D sensors are required to support these and future efforts.

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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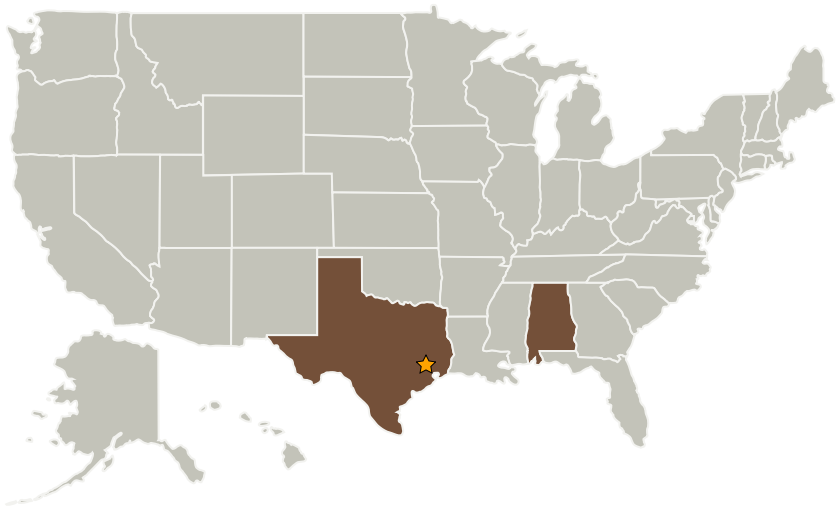
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Advanced Optical Systems, Inc.	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Texas

Project Management

Program Director:
Jason L Kessler

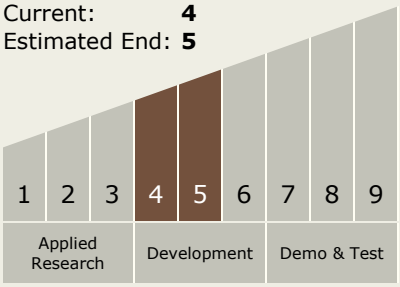
Program Manager:
Carlos Torrez

Project Manager:
Jesse A Leitner

Principal Investigator:
Fred D Roe

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **5**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.5 Autonomous Rendezvous and Docking
    - TX04.5.1 Relative Navigation Sensors